



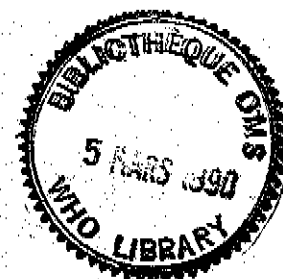
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TECHNOLOGY IN HOSPITALS - FINANCIAL AND SOCIAL ISSUES
RELATED TO THE USE OF TECHNOLOGY

Report on a WHO Working Group

Padua
18-21 October 1987



1989

EUR/HFA target 27

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TARGET 27

Rational and preferential distribution of resources according to need

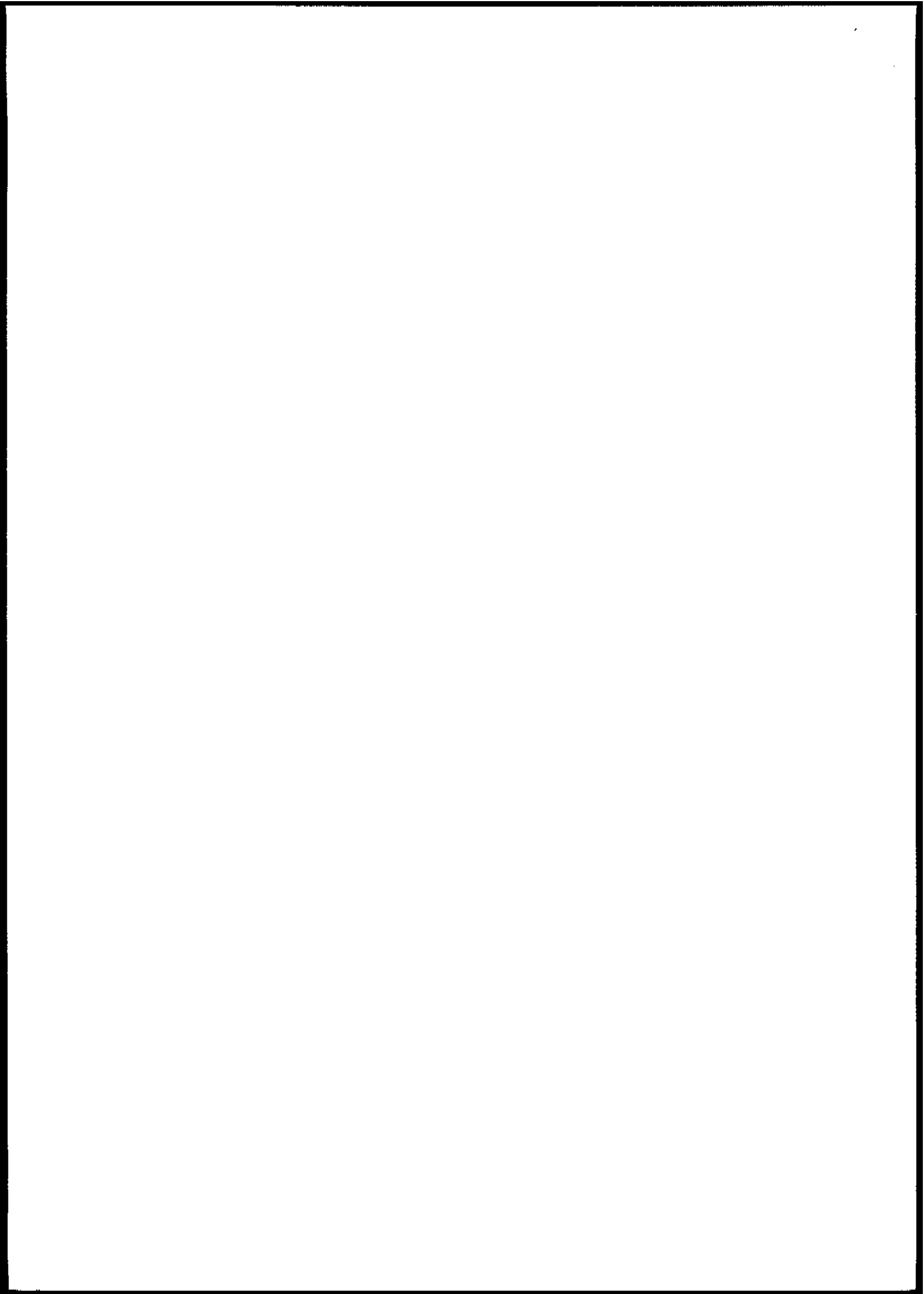
By 1990, in all Member States, the infrastructures of the delivery systems should be organized so that resources are distributed according to need, and so that services ensure physical and economic accessibility and cultural acceptability to the population.

Index:

TECHNOLOGY, APPROPRIATE
ECONOMICS, HOSPITAL
HOSPITALS
TECHNOLOGY ASSESSMENT, BIOMEDICAL
ETHICS, MEDICAL

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1. Introduction

A Working Group on technology in hospitals - financial and social issues related to the use of technology was convened by the World Health Organization, Regional Office for Europe (WHO/EURO) in collaboration with Sovraintendente Ospedale, Regione del Veneto, Padua, Italy, 18-21 October 1987. The meeting comprised 24 participants. (List of participants is given in Annex 1). Professor L. Diana (Italy) was elected Chairman and Dr A. McGuire (United Kingdom) was elected Rapporteur.

1.1. Scope and Purpose

Technology plays an important role in hospital care as well as in the overall provision of health care. Consideration of appropriate hospital technology involves assessment of financial, economic, organizational, social and ethical factors amongst others. The aim of the Working Group was to clearly identify ways in which these factors were influencing and to what extent they should influence the application of hospital based technology in different countries. The principles of appropriate technology use were subject to clarification with, in particular, the relationship between technology use and ethical justification receiving attention. The acquisition and diffusion of technology and its relationship to hospital based health care was also considered. The impact of technology on the relationship between primary and secondary health care received particular attention.

1.2. Participants

It is worth noting the wide mix of specialists that attended and contributed to the Working Group. A very broad spectrum of expert advice was available ranging from technical specialists, including clinical engineers and clinicians, to administrators, social scientists and philosophers. This broad spectrum allowed a full and wide ranging discussion of the topic to hand. This reflected a difference from normal WHO programmes in that the broad mix of the group allowed issues of hospital technology to be approached in a multidisciplinary manner. The interest in the subject matter covered by the Working Group was reflected in, not only the range of professional backgrounds provided by the participants, but also the diverse countries represented. Participants were drawn from Belgium, Denmark, the Federal Republic of Germany, the German Democratic Republic, Hungary, Italy, Poland, the Netherlands, Spain, Sweden, the United Kingdom, France, Yugoslavia, Austria and the USSR.

Against this multicountry/multidisciplinary background the Working Group was able to give an overview of the state of the art of technology use in the European hospital sector. Particular developments were noted by individual participants as being of specific value. Particular interest was also focused on high technology developments and their impact on, for example, the costs, financial, economic and moral, of maintaining life in the hospital sector. As well as making a number of recommendations, as listed at the end of this report, the general discussion, and specifically the panel discussion on the hospital of the year 2000, raised a number of interesting topics which require further attention. These discussions are presented in the main report.

2. Presentations and Discussion

2.1. Policy management questions relating to the organization of technology: some definitional issues

After the opening addresses the first day of the meeting was concerned with the policy environment relevant to organization of hospital technology. As to be expected the opening session was largely concerned with definitional issues. This presentation outlined the definitional parameters, the vocabulary and the boundaries for the sessions. This was particularly important as, given the potential breadth of topics, subjects and actors that could be deemed relevant to the Working Group, it was essential to focus on a manageable range of parameters to contain our discussions. This first presentation gave an aggregate view of the numerous actors and their relationships defined as relevant to the consideration of hospital technology. It was shown that private industry, regulatory bodies and societal representatives were all important actors who had some contribution to make to the use of technology in the hospital sector. As such decision making processes relating to hospital technology would leak out from within the hospital sector itself. The wide range of decision making actors reflected the various issues relating to the research and development of technology; the safety and efficiency of equipment; the correct technical and clinical use of technology (i.e. issues of quality assessment); and issues relating to the efficient use of technology (i.e. allocative and diffusion issues relevant to technology assessment). Underlying each of these issues were various fundamental questions which relate to design and technical validity; risk management, maintenance and repair; and the economic and ethical acceptance of new technology. Thus policy decisions relating to hospital technology could not be easily confined to particular experts, but had to be considered at a broad level and would involve engineering, clinical, economic and ethical issues.

Perhaps not surprisingly, given that this first session dealt with definitional issues, the discussion was wide ranging. Technology was agreed to be an instrument to be used for efficiency gains as applied to health outcomes. It was recognized that there was considerable uncertainty associated with technological advance. This of course leads to difficulties of implementation when new technology becomes available but it also stresses the importance of guidelines for and the regulation of technological advance. Particular emphasis was placed on the appropriate level of decision making relating to questions of who should be involved in questions of technological assessment. While it was recognized and agreed that the purely technical aspects of decision making had to be left to experts, it was also felt that such experts should merely provide the relevant information which was required to assess the usefulness of new technology. Moreover, while it was acknowledged that while some clinical assessment of hospital technology would be an obvious requirement, it need not always be a dominant one. It was deliberated as to whether or not technology assessment ought to be a societal, (e.g. as reflected in the use of political representatives as the relevant decision making body), rather than individual expert, task. Given that technological advance is an instrument aimed at achieving greater efficiency it was felt that a society wide approach was optimal but not necessary in every case.

One aspect of technology assessment was held to be of particular importance, that was the question of quality as it related to technology operation. Quality was implied to be a characteristic of technology rather than an intrinsic attribute. As such it was seen as an enhancing feature which accounted for the attraction of the introduction of new equipment. In defining quality as a characteristic feature of technology the group hoped to circumvent the difficult philosophical questions associated with the definition of the term quality. It was also noted that quality includes organization and management aspects as these relate to technology. This leads to a high level of cooperation being required between engineers and managers and also the importance of interdisciplinary teams in the hospital sector.

While the group did tend to focus initially on descriptive definitions it was quickly appreciated that the relationships between different decision making bodies would have to be defined. In particular discussions focussed on the importance of the relationship between industry, the hospital and the regulators of health care. It was felt that industry was sometimes more responsive to profit levels than to health care requirements and that in having control over the development of technology could manipulate the future of hospital based treatment. In this sense it was recognized that the industry producing technology was largely out of the control of the governmental regulatory bodies. However, an analogy between the pharmaceutical industry and the new technology manufacturing industry was made which prompted the comparison of ethical pharmaceuticals and ethical technology.

As such, the short preliminary discussion was productive in focussing on a number of definitional issues. However, the group was beginning to move towards a discussion not only of definitions but also relationships and the identification of decision-makers generally.

2.2. Rational clinical decisions in the use of technology

A number of the papers in this session devoted to rational clinical decision-making and the use of technology in the hospital sector were concerned with the role of the bio-engineer in the clinical setting. The role of the bio-engineer was stressed with regard to three major activities in each of the papers presented in this session:

- (i) with regard to the importance of the decision to acquire/purchase technology;
- (ii) the monitoring of technology;
- (iii) the training of personnel.

As such it was argued that the bio-engineer plays a vital continuing role in the hospital sector. He should be involved at as early a stage as possible to ensure costly errors are not made at the purchase stage. In the operation of technology, while this should be carried out in conjunction with the clinician, the bio-engineer should be fully involved to ensure that continual

evaluation is made of the technical efficiency of the equipment and that it is responsive to changing needs. However, monitoring of technology should also involve continual maintenance of equipment both at a preventive and repair level. The bio-engineer should also act as a consultant with regard to safety standards. Indeed it was argued that quality control measures related to the full monitoring of equipment, including the safety regulation aspects. Given the continued involvement of the bio-engineer from purchase through operation, quality control and maintenance, it was determined that the training requirements were of critical importance. Problems associated with training included the recruitment of suitably qualified personnel and the retention of trained staff within the health care sector. It was felt by some members of the group that particular aspects of training should be developed. Maintenance education was deemed especially important.

The Working Group heard that there was a shortage of clinical/biomedical engineers, as based on a concept of need. This need was related to some absolute requirement level which was specified either in terms of a ratio of bio-engineers to other staff or with regard to the demand for technology. However, it was argued by some of the members of the Working Group that some of the demand for technology was not necessarily justified. As, for example, manifested in the appropriate use of equipment, or that some technology was not discussed in detail, although it was argued that these demands related to clinical requirements. As such there was some question mark over the appropriate level of need for engineers, i.e. that it was unclear how the need for bio-engineers is determined, or who determines this need. To some extent, in that the demand for hospital technology is derived from the patient's demand for treatment, it was acknowledged that the clinician would have some role in determining hospital technology. Although it was generally agreed that this role need not be dominant.

Indeed, while there was agreement on the limitations of the clinical role, there was less on the role of the bio-engineer. At least three functional levels of operation were identified as being potentially within the remit of the bio-engineer:

- (i) he could clearly advise on technical issues concerned with equipment;
- (ii) if he was also a qualified clinician he obviously also had a clinical role - although it was agreed that there were far too few such individuals in the hospital sector;
- (iii) there is also a management role relating to organizational issues and the use of hospital technology.

Another aspect of this session related to the empirical evidence and the methodological approach to be adopted in monitoring the use of hospital technology. Taking the latter issue first, it was proposed that as technology is merely an instrument used to achieve the presumed objective of improved health status, and in this sense is no different from any other aspect of treatment, then we may use similar criteria to judge technology as is used to judge any form of treatment. In particular it was proposed that with new

technology, as with new diagnostic measures, assessment could be carried out by means of randomized controlled trials. However, randomized controlled trials (RCTs) have to be undertaken with some caution. It is as well to subject them to careful consideration viz:

- (i) what is the precision of the test statistics?
- (ii) what is the accuracy of the test results?
- (iii) what are the consequences for the patient undergoing or not undergoing treatment?
- (iv) is the trial risky or unpleasant from the patients' point of view?
- (v) what are the costs of introducing the treatment?
- (vi) are there any available substitutes which are more effective and more efficient?

Even with the caveats imposed through the difficulties associated with RCTs, it was acknowledged that they could be a useful tool in aiding decisions to introduce new technology.

While the undertaking of RCTs may aid with the introduction of new technology it was also acknowledged that there is little information on existing technology in the hospital sector and its uses. It was agreed that there is little quantification of the amount of equipment in existence or in use in the hospital sector. Nor was there any evidence available on the different uses to which similar equipment was being put. To some extent there was an intuition that it was the 'little ticket' (i.e. small pieces of equipment) technology which was prolific in the hospital sector rather than the 'big ticket' technology. There had been some data collected in Italy relating to the amount and type of hospital equipment in use which, although it had not yet been fully analyzed, supported this conclusion. The study related to a cost/activity analysis of radiological and clinical laboratory services. The data collected related to particular machinery and equipment which had been classified according to use and type of equipment. It was a difficult task even to compile a simple classification as even different departments within one health authority used similar technological equipment for different uses. It was also found that in trying to define procedures for preventative maintenance, for example, the diverse application of technology raised considerable problems.

Relating back to earlier discussions over the purchase of technology, the Italian study had found that there were no cost centres relevant to the purchase of technology, as technology tended to be purchased through individual departments as determined by their individual requirements. This also had implications for the training of staff related to technology use. As there was no centralized control of technology it would be difficult to implement training programmes which were common to all medical specialities. However, it was suggested that one way around this would be to centralize both

the purchasing and training aspects associated with hospital technology within individual health authorities. This would avoid unnecessary duplication of equipment and given that, at least according to the Italian study, the public hospital sector purchases 80 per cent of total medical equipment output, this could result in considerable savings. Indeed, the results also highlighted that while technology is normally considered to be a durable commodity, in the clinical engineering department 40 per cent of the budget for equipment was spent on consumables such as X-ray films.

This raised the general problem that decisions about the supply of technology tend not to be centralized in most countries. We did hear that the Federal Republic of Germany did in fact have a centralized planning system for technology purchases which were above a certain decreed amount. However, even here there had been difficulties in that, until relatively recently, such controls had only operated with regard to the hospital sector with the result that the primary sector had become increasingly high tech. This highlights the need to control overall capacity levels of technological equipment in both the hospital and the primary care sector.

The basic data required for a full consideration and evaluation of the use of existing technological equipment was shown to be enormous and indeed the Italian experience suggested that it was difficult to relate this basic data to outcome measures. For example, in considering technology use and avoidable deaths it was suggested that such information would be difficult to collect, mainly due to litigation fears. Nevertheless, it was considered important to collect basic data on the numbers, type and use of existing equipment.

Definitional problems were never far away and continued to appear during the discussions. Some definitional problems were concerned with technical terminology, for example, the difference between quality assurance (which was defined to relate to clinical assessment of technology use) and quality control (which was defined to relate to the engineering efficiency of technology). However, other definitional problems were of a more fundamental nature. For example, it was generally agreed that the existing technology can define disease and disease classification through its relation to diagnostic ability. There was also agreement that there are at least three parties which may be defined as the users of technology:

- (i) the patient who uses technology as an aid to diagnosis and treatment;
- (ii) the doctor who uses technology as part of his recommended treatment, but also as an aid to diagnosis;
- (iii) society generally who may pick up the cost with regard to the introduction of the technology.

The general conclusions reached with regard to this session were as follows. That the promotion of the establishment of Clinical Engineering Departments would be helpful in establishing an organizational framework for bioengineers. This would also help centralize control over the purchase, use

and monitoring of technological equipment. This would also help to promote the demand for engineers in the hospital sector, although it was recognized that this demand is reliant upon the demand for technology itself and that the demand for technology is largely undefined. It was also agreed that continued monitoring and assessment of health care technology was required, particularly as needs changed continually. One suggested means of doing this was the establishment of model centres of hospital technology. Although it was pointed out that the technology appropriate in one environment may not easily transfer to another. Similarly, with regard to training and education centres, what may be applicable for one country may not transfer across to another very easily. It was also felt that it would be useful for a central agency to monitor health care technology and management, to publish results and disseminate information.

2.3. The acquisition of technology: economic and ethical considerations

In considering the economic aspects of technology assessment it is important to recognize that health care technology has a life cycle consisting of different stages: basic research, applied research, development, production, adoption and use. Technology assessment normally focuses on the last two phases: adoption and use. Unfortunately assessments are generally not undertaken in a strategic manner, i.e. in phase with the life cycle. Technological assessment tends to be a one-off exercise which thereby disregards the inherent dynamic aspect of the technologies lifecycle. Technology assessment should rather be seen as an iterative process which involves prospective assessment of future technologies, assessments for efficacy and safety early in the life cycle, assessments for efficacy and safety later in the life cycle, assessments of costs and cost-effectiveness as early as possible and assessments of the effects of the technology after diffusion into general use. Such a complicated set of activities requires a systematic approach. A system or process of technology assessment may be viewed as an interdependent flow of four types of actions:

- (i) identification - monitoring technologies, selecting those in need of study and deciding which to study. This is the priority setting stage;
- (ii) data collection and analysis of those technologies selected for study;
- (iii) forwarding results of analysis and the recommendations for policy based on analysis;
- (v) dissemination of results and recommendations.

It is important to emphasize how little is undertaken with regard to these actions at the moment. Very few countries have the necessary institutional base to carry out these actions i.e. there are very few central agencies

concerned with technological assessment. We have also already discussed the lack of appropriate data for such assessment.

Of course assessment is not the end stage. If technology diffusion is to be controlled we must also regulate its use. In principle regulation may be undertaken through incentive or directive. Regulation by directive is more often applied to the early phases of the life cycle of health care technology, i.e. the research and development phases, while regulation by incentive is more often used to guide the later phases of the diffusion processes. It was suggested that the promotion of regulation by directive is not in itself sufficient as directives normally involved adverse effects upon incentives. Thus governments should strive towards the incorporation of incentives in regulating technology use to attempt to amend behaviour and achieve greater efficiency in the health care sector. It was agreed that some experimentation with incentive structures would be useful. It was however emphasized that any regulation of a health care system can only operate effectively if the objectives of that system are clearly defined. In other words the goals of the health care system must be discussed and agreed upon before the means to achieving them are set. Within the overall objectives of the health care system, the major task of technology assessment in health care is to improve the basis of policy decisions concerning technology. However, the gains to be realized from technology assessment programmes will only be realized if the organizational structure exists which allows strategic planning and evaluation of the health care system to be undertaken. If this structure does exist then one means to improve decision-making with regard to technology assessment is to implement cost-benefit analysis with respect to new technology. The aim of cost-benefit analysis is, as implied, to weigh up the social costs and the benefits associated with any action to determine whether the benefits derived are greater than the associated costs. If this is the outcome then we can state that we have a potentially efficient outcome, with efficiency determined by the achievement of the greatest net benefit. The formal analysis of costs and benefits helps the policy maker in attaining recommendations by tabulating alternatives. It is important to stress that the cost analysis is not confined to financial costs but incorporates the notion of opportunity cost, i.e. the fact that the resources used for a particular project could have been usefully employed elsewhere. Note also that the benefits from any action are at least considered if not quantified. Since the objective of economic appraisal is to seek efficient and equitable uses of resources it is important that all potentially efficient and equitable options should be examined. However, since the potential uses of health care resources are virtually infinite, the options examined have to be selected as being those considered to offer the greatest potential. This emphasizes how economic appraisal builds on epidemiological evaluation and clinical trials. After efficacy and effectiveness are proven, efficiency gains must be determined.

If there is a fixed benefit or health effect to be gained, the objective of cost-benefit analysis is to seek the most technically efficient i.e. least cost - way of achieving this objective. Questions of technical efficiency are addressed using cost-effectiveness analysis.

A particular form of cost-effectiveness analysis that is becoming increasingly popular is where the benefits/health effects are expressed in terms of 'quality-adjusted-life-years' (QALYs) gained. QALYs attempt to measure quality of life as reflected in varying degrees of disability or distress faced by individuals.

The effects of a project may be spread over time and, hence, it is necessary to weight future vis-a-vis present effects. One means of doing so is to discount future costs and benefits at a higher rate than present costs and benefits.

While in practice such cost-benefit analysis is likely to be helpful in assessing new technology, the decision-maker responsible for the final choice of project may not, of course, choose the project declared to be efficient. The data on which the analysis was based may be inaccurate and the decision-makers may feel that, with their more extensive knowledge, some other project is more efficient. Or they may disagree with the value judgements that the analyst will necessarily have introduced into the appraisal - as in the way in which different costs and benefits have been valued or allowance has been made for uncertainty. Or they may decide that a more equitable, but less efficient, project should be chosen. Nevertheless, the process of undertaking a cost-benefit analysis does mean that empirical evidence and justification will have to be provided for each decision, which is obviously fruitful if rational decision-making is to prosper.

While the rationale and mechanics of cost-benefit analysis were outlined with regard to questions concerning anesthesia and intensive care, it was accepted that the techniques were widely applicable. In particular it was agreed that technology assessment would benefit from the introduction of such techniques and that, even if the data requirements were substantive, the introduction of such techniques would be productive. There was however little discussion of applying cost-benefit analysis retrospectively to evaluated old and existing technology to consider whether this was effective or efficient. In principle this presents no difficulties and indeed data may be more widely available.

The assessment of the costs and benefits associated with technology use incorporates consideration of ethical problems. The Working Group broached these problems on two distinct levels: organizational aspects and humanitarian aspects. With regard to the former, it was agreed that the hospital is a complex economic institution which attempts to deal with the diagnostic and prognostic uncertainties associated with individual cases. Patients rely upon their doctors not only as providers of hospital care but also as professional agents who determine their consumption (i.e. their treatment). Obviously this places the doctor in a very powerful position, and subsequently the ethical indoctrination of the doctor becomes a crucial mechanism which acts as a check to ensure quality of performance. In an attempt to alleviate the uncertainties associated with the provision of hospital care the doctor builds up service capacity as a means of hedging against these inherent uncertainties. It is against this background that the role of the hospital technology should be assessed. As such it is likely that clinicians will use

technology as a buffer against the inherent uncertainties faced in the hospital sector. This gives some rationale to the presumed excess capacity and duplication of technology found in this sector. In particular, there is a tendency to introduce new technology as an extension to existing hospital services rather than (as occurs in many other sectors of the economy) as a more effective and more efficient replacement for existing processes. Moreover, at a time of increasing demographic pressures upon the hospital service, it is not surprising to find high technology use applied to increasingly marginal cases.

The fact that the clinician has so much control over treatment activities and belongs to a self-regulating profession means that external regulatory control over the use of technology will be difficult to implement; not only is there liable to be prolonged debate over the effectiveness of particular uses of technology, but given that the doctor will feel it is a curtailment of both the capacity he constantly uses as a buffer against the inherent uncertainties he is dealing with and his duties to act as an agent for the patient, it is likely that the medical profession will resist assessment techniques. This reiterates the important efficiency potentials associated with direct regulatory schemes and incentives noted above. If the effect of external controls are unpredictable then self-regulation may be considered advantageous. Yet it is difficult to see how such regulation will help curtail the dissemination of technology without undermining the agency role. Certainly greater understanding is required - particularly on why certain innovations are selected and others dismissed, and on the diffusion of technology through the hospital sector, before an efficient incentive mechanism aimed at controlling hospital technology is devised. Again data constraints were held to be an important blockage to our understanding, although it was widely agreed that we have little conceptual understanding of the role of clinical decision making as it impacts on technology use.

Recognition of the importance of the ethical implications associated with technology use is of course fundamentally important, but it is only a beginning. It must also be recognized that there is considerable choice over the appropriate ethical base to utilize in decision-making. Moreover, there may be no objective answer to ethical dilemmas - value judgements have to be used to justify particular courses of action.

With regard to the choice of appropriate ethical base we may distinguish between utilitarian approaches and deontological approaches. Very crudely we can state that utilitarianism advocates that "the end justifies the means". However, it is important to recognize that we can apply this general ethical rule to different levels of aggregation: we may apply it purely to the individual patient in that we can choose that decision which has the best consequences for our individual patient under current treatment, or we could apply the rule to society as a whole and choose the decision which has the best consequences for everyone concerned. There is obviously a difficulty in reconciling the levels of aggregation at which the rule is applied. Moreover, there are difficulties associated with the justice or fairness of this ethical basis: is everyone to be treated in exactly the same manner irrespective of, for example, age?

Yet utilitarian is not the sole ethical basis to which we have recourse. Deontological theories suggest that some features of any decision other than, or in addition to, their consequences are also important. Such theories place particular importance on the notion of patient autonomy. Thus, there are obvious conflicts between utilitarian approaches, which stress objectives and consequences, and deontological approaches which stress other aspects of decision-making, for example duties and rights. Not only are there conceptual problems associated with the value judgement which must be made in choosing an appropriate decision-making ethical base, pragmatic problems also exist. It is not possible to determine the appropriate value judgement through examination of any particular decision - value judgements must be made independently. In other words, it is not possible to determine what decision ought to be made from examining what is presently practiced. Furthermore, ethical codes are not decided on in isolation from social traditions. Social institutions, culture and norms will impact on the choice of appropriate ethical base. The problems associated with arriving at the appropriate value judgements were agreed to be properly broached at a societal level.

Yet ethical considerations are also pertinent to decision-making at the individual level. In particular the impact of technology use on individual autonomy and dignity was discussed. It was stated that technology, while useful as an instrument to help attain mankind's needs, may also threaten man's survival. Pollution and the threat of nuclear war were given as ever present examples of this threat. In the medical context the impact of hospital technology on individual dignity was stressed. Medical intervention without consent was widely agreed on as being a fundamental encroachment upon dignity. Modern technology has provided substantially better equipment for diagnosis and treatment. It was stated however, that it is not always easy to state whether the application of new technology reinforces or violates the individual's autonomy. Examples concerning the definition of conception (as related to in-vitro fertilization) and the definition of medical death were discussed as areas in which the use of medical technology is particularly prone to ethical dilemma. It was argued that there is not case for absolutes with respect to ethical dilemmas and that each and every individual is entitled to hold their own moral beliefs. The important differentiation between the theoretical and practical platforms of discussion was highlighted. While it was agreed that ethical committees are useful in clarifying the important ethical problems in medicine, it was also agreed that no ethical committee can relieve a doctor of their duty to think autonomously and to decide on moral issues for themselves.

The importance of ethical justification in the hospital sector was vividly highlighted by the assessment of quality of life issues. It was agreed that the quality of life as well as survival was an appropriate definitional parameter in medical decision-making. There was general discussion over the definition of the quality of life. It was suggested that quality of life is one aspect of the difficulty in defining health generally. While it was agreed that a very restricted definition may be of use for policy purposes, it was argued that quality is an important subjective matter. Nevertheless, it was generally agreed that subjective evaluation of a number of dimensions of health could be utilized as a useful policy instrument to

evaluate the health outcomes associated with health care policy. In particular, the use of quality adjusted life years as a measure which utilizes both survival and quality of life data within one index was seen to be an important extension for use in assessing policy. The use of such indices as applied to clinical trials was demonstrated. It was suggested that there is no wise agreement on the appropriate index to be utilized and a number of such indices and approaches were discussed. However, it was agreed that with all of the approaches highlighted that it is possible to measure at least some dimensions of quality of life in a scientific manner. Again, there was a call for the collection of better and more comprehensive data. It was agreed that such approaches should be developed with increased application.

2.4. Diffusion and transfer of technology in the hospital sector and between the primary and secondary health care sectors

In considering the diffusion and transfer of technology in the hospital sector it was highlighted that the hospital is traditionally a health care institution in which doctors practiced medicine for their patients. The agency role of the doctor was emphasized again. The development of technology has, to date, led to a greater integration of medicine in the hospital sector. The cost of high technology has become such that it is no longer feasible for the individual specialist to purchase such equipment. Also, as equipment specialization increased individual doctors had to work with other specialists both on the medical and paramedical side. Thus, the medico-technological evolution has caused the integration of the doctors into the hospital. However, it has also had the consequence of increasing the cost of hospital care.

In order to regulate costs the authorities of the hospital sector historically applied regulatory instruments to the basic equipment provided by the hospital sector - the bed. Thus planning and financing, for example, was determined with regard to bed levels. However, it may now be more appropriate to determine regulatory instruments with respect to medico-technical apparatus (and in particular expensive high-tech machinery) given the cost and rate of diffusion of such equipment. Such regulation is justified not simply on cost grounds but also because high technology all too often appears to overlook the daily requirements of patients.

It was also noted that the increasing use of technology in the hospital sector alters the nature and scope of the work load of the personnel. Medics become increasingly concerned with the technical requirements of the equipment - thus moving away from their traditional agency role. The role of nurses also changes with more attention given over to equipment rather than to direct patient care. There is also the clear impact of such changing roles, as well as the use of technology, on the rights of the patient. While regulation can be utilized to protect the patient's rights, there is also a clear need for health legislation. In addition to medical and medico-technological research, fundamental legal research in this area is also worthy of recommendation. It was also agreed that more research into the causes, pattern and nature of hospital technology diffusion is necessary. International collaboration is

clearly essential here to assess the difference in the impact of ethical structures as well as whether similarity in diffusion exists.

It was also noted that in the past hospital technology had generally been applied to diagnostic procedures. However, it was increasingly being introduced with regard to therapeutic procedures. Importantly, it was acknowledged that these therapeutic procedures were essentially "large ticket" and correspondingly expensive. It was further noted that hospital technology had expanded rapidly in the 1970s within the teaching hospital sector but was now feeding through to the general hospital sector, with a consequent increase in the volume of equipment and cost. Investment in hospital technology, it was argued, may have reached a plateau for the moment, but this was the result of cost containment policies rather than demand levelling off. It was suggested that there is a growing need for regulation, but that such regulation had to be kept flexible enough to maintain the incentives for innovation, as it is through innovation that future technological structures will evolve. At the same time regulatory directives should aim at controlling the diffusion of new technology. Thus, both incentives and directives could be used at different phases of the technology product cycle as argued above. Incentive could be aimed at ensuring a continued flow of effective, efficient health care technology, while directives could control the stock of such technology at any particular time.

The latter was particularly important given the tendency for the role of hospitals to continue expanding, thereby adding extra functions and thus costs to their budget. This had been particularly pronounced in the post-war period by the differentiation of specialities. In turn this had led to a profusion in the application of hospital technology to different specialities which had increased the rate of diffusion. Moreover this had also tended to exaggerate the role of substitution of different types of health care (e.g. hospital inpatient and outpatient). Certain types of health care could now be provided on an out-patient basis which were previously only available on an in-patient basis. This had affected the distribution as well as the production of health care and led to differential growth across the health care sector in technology use. It was noted that the organization and financing of health care are important determinants in the diffusion of hospital technology. As such it is important to attach the costs of technology use to the appropriate health care sector if we are to properly trace the flow of resources associated with such use.

2.5. Hospitals 2000 - the hospitals of the future

It was emphasized how close the year 2000 is in terms of planning horizons. Hospitals being built today will be in operation well into the next century. The importance of the aging demographic structure of the European countries was also stressed. If hospitals and hospital technology were to be assessed for our needs in the year 2000 it was important that the advisory agencies began collecting and collating appropriate data now if our needs were to be met. It was agreed that the WHO could play a vital role here.

With regard to structural changes, it was suggested that technology pressures could operate in one of two directions. Because of costs and the pressures to control costs increasing technology use could lead to greater centralization of resources towards the hospital sector, but while we would witness a centralization of funds and resources into the hospital sector the hospital itself would diversify across specialities. Therefore, although resources would be increasingly drawn into the hospital sector, the hospital itself would become increasingly modular. Flexibility would be a major objective. This flexibility must be controlled within an environment where the industrial policy of manufacturers would increasingly become one of the "hard sell"; where financial constraints would increase; where consumer pressure would continue to demand high quality care; where the increasing number of clinicians would result in increasing demands for technologically pushed growth. This would lead to an increasing role for technology assessment and regulation. However, such regulation should not be aimed solely at new procedures. Existing procedures should also be continually monitored to assess the role of existing technology under changing and evolving conditions.

Alternatively, it was suggested that new technology would lead to a decentralization in medical procedures with pressure to move technology downstream to primary health care providers. This would, it was argued, be in line with the demands of the consumers of health care. However, it was agreed that the pressure to contain costs would probably mitigate against such a move.

Associated with these structural changes we would also witness changes in attitudes towards health care. Such attitudes were continually evolving. In the 1950s and 1960s medicine was looked upon as a progressive and successful application of science. However, in the 1970s it was widely acknowledged that a large number of "successes" had not been scientifically verified and that a number had encroached upon the rights of individual patients. This had led to a growth in the application of randomized controlled trials as well as the growth in the teaching and acceptance of the importance of an understanding of medical ethics. At the same time cost consciousness has led to increased pressures to contain health care costs. As such the introduction of technology into the hospital sector is likely to slow to a lower rate. New technology is liable to be subjected to more rigorous testing before application. However, the simultaneous awareness and respect of human rights means that the conflict between concern for the individual and the need for a fair distribution of the limited amount of health care resources will intensify. This may lead to an increase in the numbers of centres of medical excellence supported by more general hospitals.

It was agreed that all such changes would lead to shorter lengths of hospital stay and higher patient throughput. This may lead to the development of a larger nursing home sector for recovery which, given the policies of cost containment, may be privately funded. Also increased family responsibilities would emerge for caring for the sick. This would especially be the case for the very old. At the same time the skill requirements of labour within the hospital sector would be increasing thereby adding to the cost pressures in this sector.

There was general agreement that while planning was necessary it was as important to specify objectives. The hospital of the year 2000 would only be successful if it satisfied its pre-stipulated objectives. These objectives must be drawn up with full knowledge of the political, economic and social constraints imposed by the environment if they were to be attainable. After this condition was satisfied, planning should proceed on the basis of aiming to be flexible enough to respond to changing requirements. Given the uncertainties involved in planning even for the year 2000, flexibility must be ensured.

3. Recommendations

3.1. Risk management of technology in hospitals

- 3.1.1. There is a need for risk data relevant to the use of technology and a need for epidemiological analyses on the health effects of technology use in the hospital sector.
- 3.1.2. There should be a general promotion of the establishment of Clinical Engineering Departments to establish an organizational framework for bio-engineers. There should also be promotion and support for training and education schemes.
- 3.1.3. There should be increased monitoring of health care technology and management. Information should be widely disseminated.
- 3.1.4. Model centres in hospital technology use should be established in different countries and the results and information published widely.

3.2. The clinical decision-making process

- 3.2.1. The Regional Office should arrange Workshops on quality assurance and clinical decision-making in hospitals, to discuss the use of incentives to change clinical behaviour.

3.3. Acquisition of technology and economical considerations of the use of technology

- 3.3.1. Economic evaluation should be promoted. Its use should be advocated on a wide basis.
- 3.3.2. Physicians should know more about health economic issues. In order to promote this, training in health economics should be encouraged.

3.4. Ethics and technology

- 3.4.1. The Regional Office could promote discussions on the ethical basis of the health care system as a whole - advance ethical systems related to the use of technology.

3.4.2. The interaction between ethics and legislation should be analyzed.

3.5. Spread and transfer of technology

3.5.1. Need for organization of the hospital and the inter-relationship between hospitals should be analyzed.

3.5.2. Cooperation between different countries in the analysis of the diffusion of hospital technology to be encouraged.

3.5.3. There is too little data, studies and research carried out to investigate the cost-effectiveness of transfer of technology from one sector to another in health care, especially from the hospital to the primary health care field. Research on this topic should be encouraged.

3.5.4. There is not enough epidemiological data or cost data relating to hospital technology. The collection of such data should be a priority.

3.5.5. An international comparison study on equipment in laboratories should be initiated.

3.5.6. A risk evaluation and risk management Workshop should be arranged.

3.6. The hospital of the year 2000

3.6.1. What sort of hospital do we need by the year 2000?
The problems of the hospital must be integrated with the place of the hospital in the health care system by the year 2000. The need for hospitals (and the need for beds) should be discussed. The Regional Office should arrange a meeting on this topic.

Annex I

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